(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 May 2003 (15.05.2003)

PCT

(10) International Publication Number
WO 03/041369 A1

(51) International Patent Classification[7]: H04M 1/00, 9/00

(21) International Application Number: PCT/US02/32290

(22) International Filing Date: 9 October 2002 (09.10.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/975,142 10 October 2001 (10.10.2001) US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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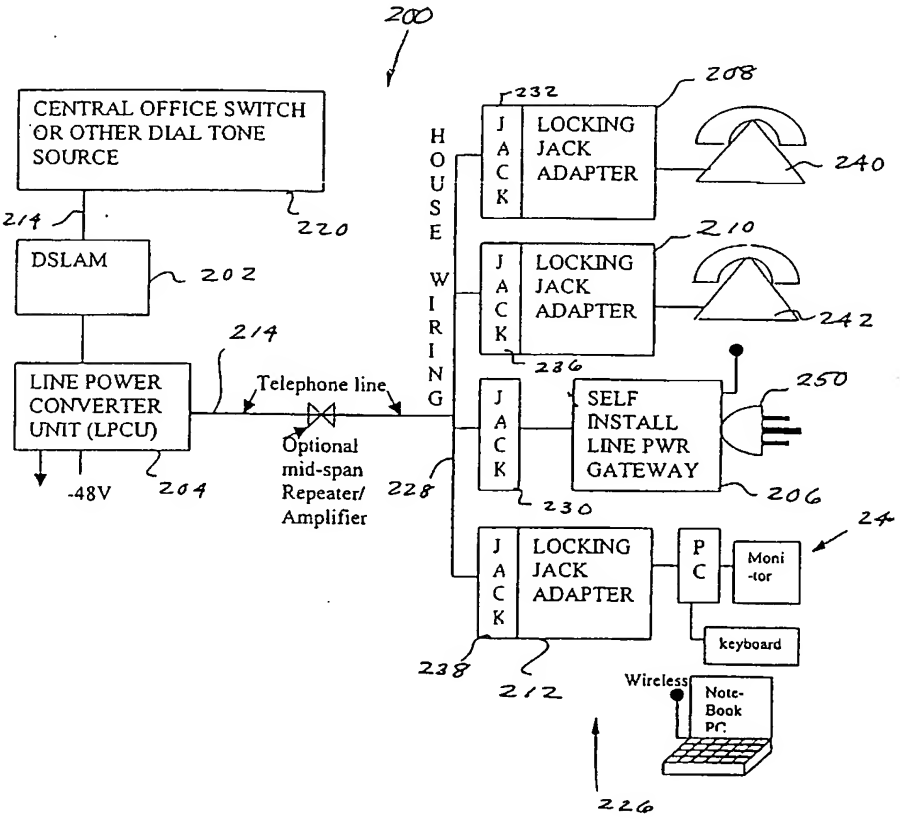
(54) Title: TELECOMMUNICATIONS GATEWAY AND METHOD



(57) Abstract: An improved system and associated components for providing reliable power supply and interconnectivity for digital subscriber line (DSL) applications at sites remote from the central office (CO), the system comprises a line power unit in communication with a subscriberinstallable gateway module, the latter incorporating a power extraction circuit adapted to extract power from the Telco line. Home phone network (HPN), homeplug, and wireless modules are also provided within the gateway to permit connectivity between other electronic components within the subscriber's site. Subscriber-installable adapter modules which extract power and perform line interface functions for the various jacks throughout the site are also disclosed. Methods for installing and operating the aforementioned components are also described.

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TELECOMMUNICATIONS GATEWAY AND METHOD

Background of the Invention

1. Field of the Invention

The present invention relates generally to electronics used in telecommunications applications, and particularly to an improved apparatus and methods for installing and operating a digital subscriber line (DSL) system.

2. Description of Related Technology

As is well known, Asymmetric Digital Subscriber Line (ADSL), and Very high bit rate Digital Subscriber Line (VDSL) can provide broadband access to various nodes (e.g., homes and small offices) "piggybacked" on the existing telephone lines. Currently, data rates of up to 8Mbit/s are possible with ADSL. VDSL utilized on shorter loops can provide data rates up to 50Mbit/s.

More recently, efforts have been made to provide additional voice lines over DSL (so-called "voice-over-DSL" or VoDSL). Using this approach, it is possible to provide many dial tone channels over DSL. However, a significant concern under such approaches is continuity of service and reliability of electrical power to the various subscriber entities served by the DSL infrastructure. Typical prior art ADSL/gateway approaches (Fig. 1) require local power, or local backup power, to supply power during outages. These approaches are comparatively costly, thereby raising the cost of providing DSL service to the service provider and/or subscriber. Additionally, backup power sources are not always (properly) maintained or available, and thus not entirely reliable.

Another consideration relates to data networking at the subscriber's site. Wireless interfaces and home phone networking (HPN) systems have become increasing prevalent. Wireless systems, including those compliant with IEEE Standards 802.11A and 802.11B or the more recent Bluetooth/3G standards, are designed to allow wireless interface between one or more mobile or remote units such as laptop computers, personal digital assistant (PDA), or telephone, without the need for telephone line infrastructure or other networking devices. These systems are often characterized by a local gateway or base station which facilitates two-

traditional data networking systems, while also addressing the issue of electrical power continuity.

Based on the foregoing, an improved apparatus and method of providing reliable, continuous power to the subscribers of DSL systems (including VoDSL systems) is needed. Such improved apparatus and methods would (i) be readily implemented by the subscriber, (ii) make use of existing telecommunications and/or power line infrastructure, and (iii) be compatible with a variety of different device types and configurations present at the subscriber site, such as standard telephones, multi-line digital telephones using home phone network (HPN) systems, wireless, and HomePlug compatible devices.

Summary of the Invention

The present invention satisfies the aforementioned needs by providing an improved digital subscriber line communications system and associated components, and methods of installing and operating the same.

In a first aspect of the invention, an improved line-powered digital subscriber line system is disclosed. In one exemplary embodiment, the system comprises a digital subscriber line access multiplexer (DSLAM), line power converter unit (LPCU), self-install line power gateway module, and one or more self-install jack adapter modules. The gateway and jack adapter modules are located at the subscriber site and plugged into the existing telecommunications jacks, with the gateway also having HPN, wireless, and HomePlug (or similar) modules being connected to the local power line (such as via a standard wall plug). This configuration provides both reliable power to each phone jack/node at the subscriber site via the existing telephone wiring, and connectivity to any number of other devices at the site via the existing power line infrastructure (and HomePlug module). The gateway module can advantageously be line powered from the serving central office (CO), or from the remote DSLAM. The line powering is accomplished by replacing the conventional CO splitter with the aforementioned line-powering converter unit (LPCU), and eliminating the prior art plain-old telephone system (POTS) connection to the CO switch line circuit. Using this system, the subscriber's line has both the DSL signal with VoDSL plus the DC power signal from the LPCU, but no telephone ringing and battery feed signals from the CO. In a second aspect of the invention, an improved DSL multiplexer (DSLAM) module for use with the foregoing

power supply; positioning one or more adapter modules in respective ones of said jacks; and plugging in one or more extension devices into respective ones of the adapter modules.

Brief Description of the Drawings

The features, objectives, and advantages of the invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings, wherein:

Fig. 1 is a block diagram of a typical prior art ADSL installation in a home or small business environment, including power supply thereto.

Fig. 2 is a block diagram of one exemplary embodiment of the gateway system of the present invention.

Fig. 3 is a block diagram and partial schematic of one embodiment of the line power converter unit (LPCU) according to the invention.

Fig. 4 is a block diagram and partial schematic of one embodiment of the DSL gateway unit according to the invention.

Fig. 5 is a block diagram including partial schematic of one embodiment of the jack adapter module according to the invention.

Fig. 5a is a perspective view of an exemplary embodiment of the jack adapter module of Fig. 5.

Fig. 5b is a block diagram including partial schematic illustrating a first (standard telephone) operating mode of the adapter module of Fig. 5.

Fig. 5c is a block diagram including partial schematic illustrating a second (HPN bypass) operating mode of the adapter module of Fig. 5.

Fig. 5d is a block diagram including partial schematic illustrating a third (digital multi-line line powered telephone or equivalent) operating mode of the adapter module of Fig. 5.

Fig. 5e is a block diagram including partial schematic illustrating a first low-cost alternate embodiment (adapted for a standard telephone) of the adapter module of Fig. 5.

Fig. 5f is a block diagram including partial schematic illustrating a second low-cost alternate embodiment (adapted for HPN bypass) of the adapter module of Fig. 5.

Fig. 5g is a block diagram including partial schematic illustrating a third low-cost alternate embodiment (adapted for a digital telephone) of the adapter module of Fig. 5.

interface standard) is also optionally provided to facilitate wireless data interchange between the system and a remote or mobile device such as a laptop computer, personal digital assistant (PDA), cellular or cordless telephone, and the like.

The line powered gateway module of the present invention can be advantageously installed by the subscriber by simply locating a power plug (e.g., 115 VAC, 60 Hz single-phase outlet) in physical proximity to a telephone jack (e.g., RJ-type modular jack), and plugging the gateway module into the power plug, with a cord running to the closest telephone jack. Instead of plugging in signal conditioning devices such as micro-filters for each phone as in a typical prior art DSL installation, the present invention utilizes one or more specially configured adapter modules which are plugged into respective phone jacks at the installation premises, and which receive extension devices (e.g., telephones) via an extension port on the adapter modules.

The aforementioned adapter module advantageously extracts its power from the wall jack as the ADSL unit does, and provides power to both an associated HPN unit (e.g., integrated circuit specifically adapted for home phone network applications) and low voltage subscriber's line interface circuit (SLIC) for a standard type telephone.

The adapter module(s) also is/are configured to provide an automatic jack sensor circuit that automatically senses the type or configuration of the device attached to the new derived port (e.g., a regular phone, an HPN device, or a new multi-line digital phone), and applies the correct interface for the sensed device. In this capacity, the adapter module is self-configuring, thereby providing for ease of installation and use, especially when switching between various types of subscriber extension devices.

The combination of the HPN signals on the existing house or building telephone wiring, the RF signals associated with the air interface, and the signals present on the homeplug (or other suitable power line technologies) running through the structure, allows ready data connection and interchange in any physical location within the structure (and potentially outside the structure, consistent with the limitations of the air interface). Any computer, notebook, PDA, or other data capable device can easily be connected around the structure via either HPN or wireless interface. Similarly, printers or other computer peripherals can also be connected and shared by all computers or other networked devices using the HPN circuitry by simply plugging into one of the installed telephone jacks present in the structure.

wiring 228 via a first modular jack 230 (here, the RJ-type, yet others may be readily substituted), while the one or more adapter modules 208, 210, 212 are interfaced with the wiring 228 via other respective jacks 232, 236, 238 located throughout the site 226. The extension devices 240, 242, 244 are accordingly plugged into respective adapter modules 208, 210, 212 as described in greater detail below, thereby providing signal continuity between the ISP or Telco switch 220 and the various extension devices 240, 242, 244. The gateway module 206 is also plugged into a nearby wall power outlet, such as the 115 VAC, 60Hz single phase variety of the type in widespread use today. It will be recognized, however, that other types of power sources may be used either in the alternative or in conjunction with the foregoing, including for example 220 VAC, 50 Hz, single phase. As will be described in greater detail below, the gateway module 206 advantageously extracts power from the telecommunications wiring 228, as do the various adapter modules 208, 210, 212 via their own respective power extraction circuits.

It will be noted that the DSLAM 202 of the illustrated embodiment differs from the standard prior art DSLAM in that the DSL of the present DSLAM 202 is also adapted to utilize the desirable 200Hz-25KHz bands for longer range (or faster data rates), plus the new or derived phone lines. Specifically, the DSLAM 202 of the illustrated embodiment utilizes a high-pass filter tuned to start at 200 Hz versus 25 KHz, as well as additional software.

The LPCU 204 of the embodiment of Fig. 2 replaces the splitters typically found in prior art configurations in the central office, and converts the – 48V input power signal 222 to a higher voltage (up to +/- 135 V) to provide the gateway module 206 with up to 12 Watts of power. The LPCU 204 in the illustrated embodiment comprises a current source of approximately 60-100 mA, and is partially under control of the gateway module's power extractor unit 406 (see discussion of Fig. 4) in order to adjust for the desired power at the gateway module(s) 206.

Fig. 3 shows the internal details of the LPCU 204 of the system 200 of Fig. 2. The DSLAM signals pass through the low frequency splitter/combiner capacitors 302 to the subscriber's line. The power feed current passes through the feed inductors 304 to the subscriber's line 308. The inductance values of the feed inductors 304 of the present embodiment are selected to achieve a resonance condition for the best hi-pass/low-pass response at 200Hz, although it will be appreciated that other frequencies and/or inductor

the system configuration to generate multiple telephone dial tone circuits, while not taking bandwidth away from the original DSL modem channel. The DSL module 430 of the illustrated embodiment comprises an integrated circuit chipset (such as the Wildwire® ADSL modem chipsets manufactured by Lucent Technologies or the Alcatel DynaMiTe™ DSL chipset, although other chipsets may be used). The use of such IC chipsets affords the advantages of low cost and space savings, as well as integrating the aforementioned control features associated with the controller 422.

As shown in Fig. 4, the gateway module 206 further comprises an HPN module 440 of the type well understood in the networking arts, which interfaces with the DSL module 430 in order to couple data from the DSL to the home network over the installed telephone lines 228. This arrangement allows the generated or "derived" phone lines to be routed over the telephone wiring 228 to any phone jack at the site 226.

Also (optionally) included in the gateway module 206 is a wireless module 450 which communicates to any remote module within or proximate to the site 226 (or for that matter with physically remote devices via a local interface) using the antenna in the gateway's wireless module 450, such as in a notebook computer or video monitor. Any number of different wireless transmission methodologies may be employed to transfer data between these entities including, *inter alia*, point to point transmission via the Infrared Data Association's ("IrDA") infrared based wireless transmission standard; wireless radio frequency ("RF") based local area network ("LAN") connections based on the IEEE 802.11A or 802.11B LAN access standards, or the Home RF Shared Wireless Access Protocol. The construction and operation of each of these air interfaces is well known in the communications arts, and accordingly are not described further herein.

In another embodiment, a "Bluetooth" wireless interface (or alternatively, other so-called "3G" (third generation) communications technology) is utilized for transferring data between the gateway module 206 and mobile or remote devices, and/or between the PC extension device and its peripherals/accessories. Specifically, in the former case, the wireless module 450 of the gateway 206 comprises a transceiver and modulator device (not shown) used in the form of an SoC integrated circuit. The Bluetooth topology supports both point-to-point and point-to-multipoint connections. Multiple "slave" devices can be set to communicate with a "master" device. In this fashion, the gateway module 206 of the present invention, when outfitted with a

entertainment systems, HVAC control systems, etc.) to communicate with the gateway module directly without the need for additional wiring or air interfaces.

Adapter Modules

The adapter modules 208, 210, 212 of Fig. 2 provide self-install capability of the line power gateway of the present invention. These adapter modules are now described in detail with respect to Fig. 5.

In the exemplary embodiment of Fig. 5, each adapter module is semi-permanently attached or "lockable" so as to prevent plugging any standard telephones or similar devices into the existing telephone wiring jacks 230, 232, 236, 238, which is necessary to prevent overloading the DC line power voltage present at the phone jacks. Instead, the adapter modules 208, 210, 212 of the present invention are plugged into the telephone jacks, and extract power from the telephone line 228 via a power extractor module 504 which is electrically coupled to the wall jack and a SLIC module 530. The adapter modules use this extracted power to provide power to an internal HPN circuit 510 within the respective modules, an/or to an HPN circuit 520 in a digital phone which is in turn plugged into the jack 524 of the module. The internal module HPN circuit 510 of each module extracts a derived phone line from the HPN module 440 in the gateway module 206 (Fig. 4), and drives the SLIC module 530 within each respective adapter module 208, 210, 212 to generate tip and ring lead signals to drive the module's phone jack 524.

The adapter modules 208, 210, 212 of the present embodiment physically lock into respective ones of the jacks in the site 226, and the standard telephones (or other comparable devices such as standard HPN interface unit or digital phone) are plugged into the jacks 524 on the adapters as previously described. Fig. 5a illustrates one exemplary embodiment of the physical configuration of the adapter modules. As shown in Fig. 5a, the module 208, 210, 212 comprises a housing element 570 having a modular plug 572 with associated locking tab 574, and at least one modular jack 524 disposed on the upper surface 578 of the housing element 570. A second jack 529 may also be provided for any variety of different purposes, such as additional extension devices, RJ-11 interface, etc. The housing element 570 and modular plug 572 are configured such that the tab 574 is rendered inaccessible by the subscriber when the adapter is installed, thereby frustrating inadvertent or unintentional removal. It will be

from the extension device, and if none is present, will determine that the device is a conventional phone or similar device. If the extension device is conventional, the adapter module communicates to the HPN circuitry (e.g., chip) to request dial tone through the gateway to the serving CO. Once the requested dial tone signal is detected from the CO, the SLIC 530 generates dial tone for the local phone which can then dial the desired number. When the off hook condition appears, the HPN signals are blocked by a relay K1 and associated switches 544, which forms a splitter 550 within the module.

If the extension device is a standard HPN device with no DC path, the HPN circuitry will sense the HPN signal from the device, and bypass the HPN signal around the adapter module circuitry as shown in Fig. 5c herein.

If the extension device is a new digital line powered HPN single or multi-line telephone, the SLIC loop current sensor will sense DC current flow and the adapter module HPN circuitry will detect an HPN request which will then bypass the HPN phone signal to the gateway module 206, and switch the SLIC 530 to the power feed mode to power the phone, as illustrated in Fig. 5d herein.

Accordingly, there are three states or modes associated with the automatic sensing apparatus of the adapter module jack 524 of the present embodiment: (i) standard telephone interface; (ii) HPN bypass; and (iii) line powered digital multi-line telephone.

For standard telephones, the power extractor module 504 obtains power from the line (wall jack), powers the HPN circuitry 510 of the module 206 to obtain a phone circuit with send/receive transmission, and provides signaling (on/off hook and ringing). The HPN 510 drives the low power SLIC module 530, which generates the 10 VDC battery feed voltage for the telephone, as well as generating the ringing voltage to ring the phone. This configuration is illustrated in Fig. 5a. For the standard telephone interface, the adapter module further includes means for setting or selecting the line (of the multiple derived lines) to connect to the adapter's phone jack. In one embodiment, this means comprises a multi-position selector switch, although other configurations (e.g., automatic selection based on parametric sampling, algorithmic control, etc.) may be used as well. Since each HPN circuit has a unique address, the line selection may be selected at the gateway upon installation as well.

Method of Installation

Referring now to Fig. 6, the method of installing the aforementioned system 200 and associated components is described in detail. It is noted that while the following description is cast in terms of the system of Fig. 2 as installed in a typical residential structure, the broader method of the invention is equally applicable to other configurations and types of sites.

As shown in Fig. 6, the method 600 generally comprises first determining scope and location of telecommunications wiring and any HPN systems within the site 226, including the number of wall jacks present therein (step 602).

Next, the gateway module 206 is positioned in a location having access to both a telecommunications wiring jack and a power supply jack (e.g., wall plug) per step 604. Specifically, the gateway module's phone line port is connected (via appropriate cabling) to the telephone jack, and the module's power plug 464 is connected to the local power supply jack. The gateway module is, in one embodiment, sized such that it's weight and bulk is mechanically supported by the power plug when the module is plugged into the latter.

Per step 606, adapter modules 208, 210, 212 are then positioned at respective ones of each of the remaining telephone jacks throughout the site 226, the adapter modules being plugged into the wall jacks such that they lock into place (if so equipped) as previously described. It is noted that not every telecommunications line wall jack must be outfitted with an adapter module 208, 210, 212; however, those not so equipped should not have a standard telephone or other device installed, since the potential for DC line voltage overload exists as previously described.

Next, in step 608, the various extension devices (i.e., standard telephones, HPN gateways, digital multi-line phones, etc) are plugged into the jacks 524 of their respective adapter modules 208, 210, 212. The flexibility inherent with the present invention is underscored here, since any of the foregoing devices can be indiscriminately plugged into the adapter module jack 524 of any adapter module without any particular configuration restrictions or additional wiring requirements (other than setting the line selection means associated with the applicable adapter module when a standard phone is plugged into the jack 524 to permit selection between multiple derived lines).

Lastly, in step 610, the system 200 is tested to ensure proper functionality. Such testing can be optionally built into the system (e.g. a self-test algorithm and supporting hardware adapted to run and provide the subscriber test results upon system installation and/or startup), or

WHAT IS CLAIMED IS:

1. Telecommunications apparatus, comprising:

modulator/demodulator apparatus adapted to receive and transmit signals over at least one telecommunications line; and

power extraction circuitry operatively coupled to said telecommunications line and adapted to generate power for said modulator/demodulator apparatus from voltage applied to said line.

2. The apparatus of Claim 1, further comprising an interface module operatively coupled to a power line and said modulator/demodulator apparatus, said interface module being adapted to transmit and receive data over said power line.

3. The apparatus of Claim 2, wherein said power line comprises a single-phase alternating current (AC) power distribution line.

4. The apparatus of Claim 3, wherein said interface module is compliant with the HomePlug Powerline Alliance 1.0 Specification.

5. The apparatus of Claim 1, further comprising a local network interface adapted to communicate with at least one other node in data communication with said apparatus.

6. The apparatus of Claim 5, wherein said local network interface comprises a home phone network (HPN) gateway adapted to communicate with said at least one node via installed telephone wiring.

7. The apparatus of Claim 1, further comprising a wireless interface in data communication with said at least one telecommunications line and said modulator demodulator apparatus, said wireless interface being configured to receive data from a portable device and communicate said data to said modulator/demodulator apparatus.

17. The method of Claim 15, further comprising adjusting said voltage applied to said line based at least in part on the distance between said first node and said second node.

18. The method of Claim 14, further comprising:

providing a plurality of power extractors at respective ones of a plurality of additional nodes, said additional nodes being in electrical communication with said second node at the location of said subscriber;

extracting power from said line using said plurality of power extractors; and

distributing said extracted power to respective ones of a plurality of extension devices coupled to respective ones of said power extractors.

19. The method of Claim 14, further comprising:

detecting ground faults present on said telecommunications line; and

in response to said detected faults, controlling the operation of said power source.

20. The method of Claim 14, further comprising controlling the polarity of said voltage generated on said telecommunications line in order to mitigate the corrosion thereof.

21. Telecommunications interface apparatus, comprising:

a first port in data communication with a telecommunications line;

a second port in data communication with an extension device;

first circuitry adapted to detect the configuration of said extension device; and

second circuitry adapted to be variably configured based at least in part on said detected configuration.

22. The apparatus of Claim 21, wherein said extension device comprises a standard telephone, and said second circuitry is configured to generate a transmit/receive dial tone compatible with said telephone.

one unique address being used to select said derived telephone line associated with said telecommunications apparatus.

31. The apparatus of Claim 25, wherein said line power circuitry is further adapted to:

(i) automatically sense the configuration of said telephonic device; and

(ii) alter the operation of said line power circuitry in response to said sensed configuration.

32. Apparatus for providing power to at least one subscriber via a telecommunications line, comprising:

a low frequency splitter operatively coupled to said telecommunications line;

a power conversion circuit adapted to generate electrical potential and apply such potential to said telecommunications line via said splitter; and

a power control circuit operatively coupled to said low frequency splitter and said power conversion circuit, said control circuit adapted to control said electrical potential applied to said line based at least in part on one or more parameters.

33. The apparatus of Claim 32, wherein said low frequency splitter comprises a plurality of inductors.

34. The apparatus of Claim 33, wherein the inductance values of said inductors are selected so as to provide a resonance condition for optimal response at a designated frequency.

35. The apparatus of Claim 33, wherein said power generation circuit provides at least a portion of the total inductance of said apparatus.

generating power from said voltage using said power extractor; and

providing said generated power to said extension device.

42. A method of installing a subscriber-side telecommunications system, said system being adapted for use with a telecommunications line having a plurality of extensions and a voltage present thereon, comprising:

installing a first module at a first of said plurality of extensions;

installing a plurality of second modules at respective ones of said plurality of extensions; and

installing a plurality of extension devices at respective ones of said plurality of second modules, at least a portion of said extension devices being interfaced via said telecommunications line.

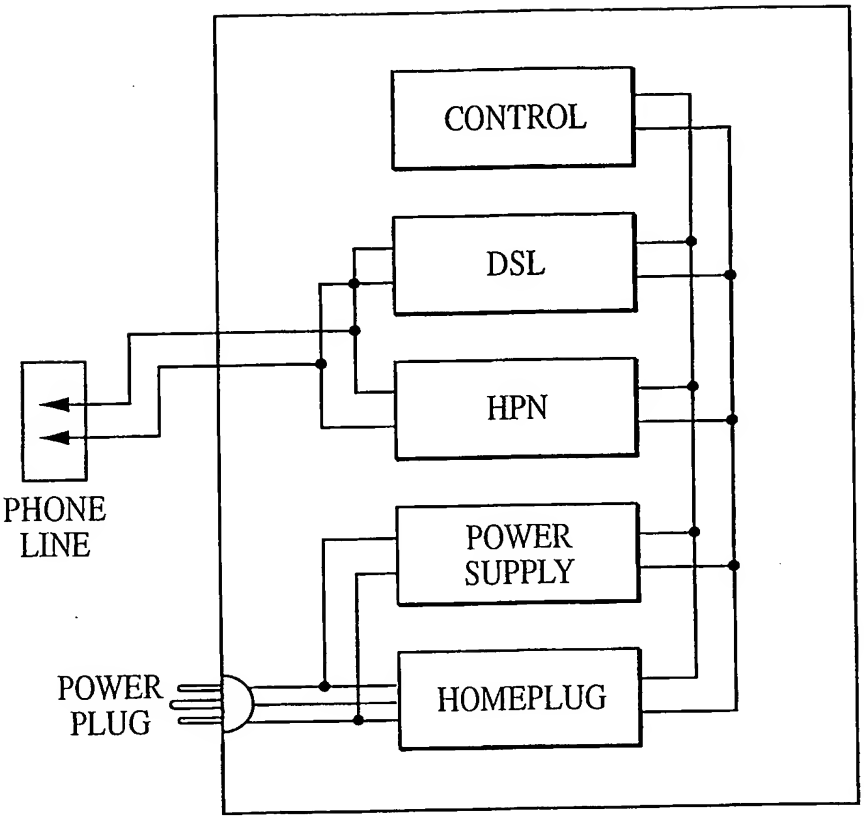
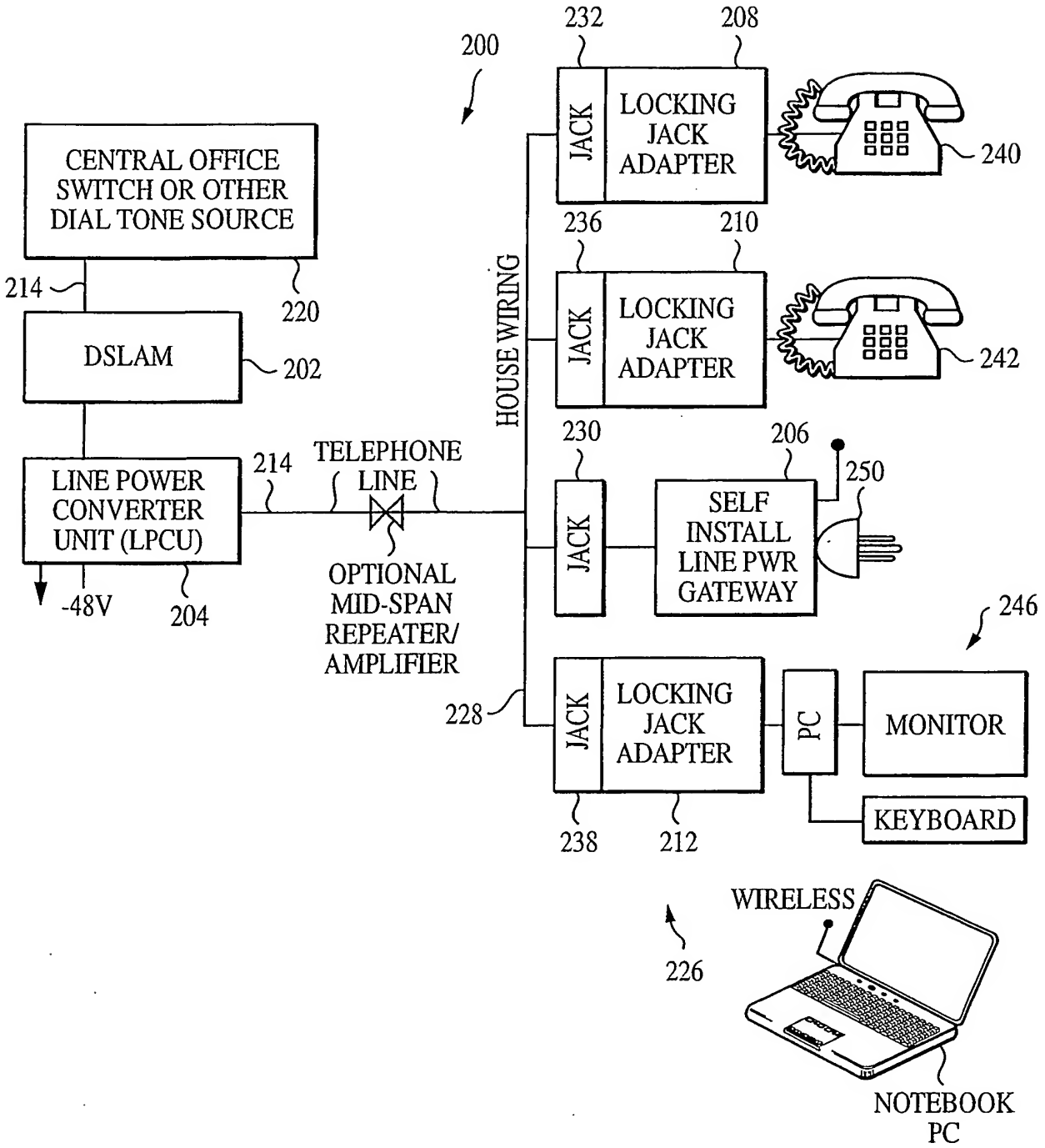


FIG. 1
(PRIOR ART)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232
208
JACK
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240
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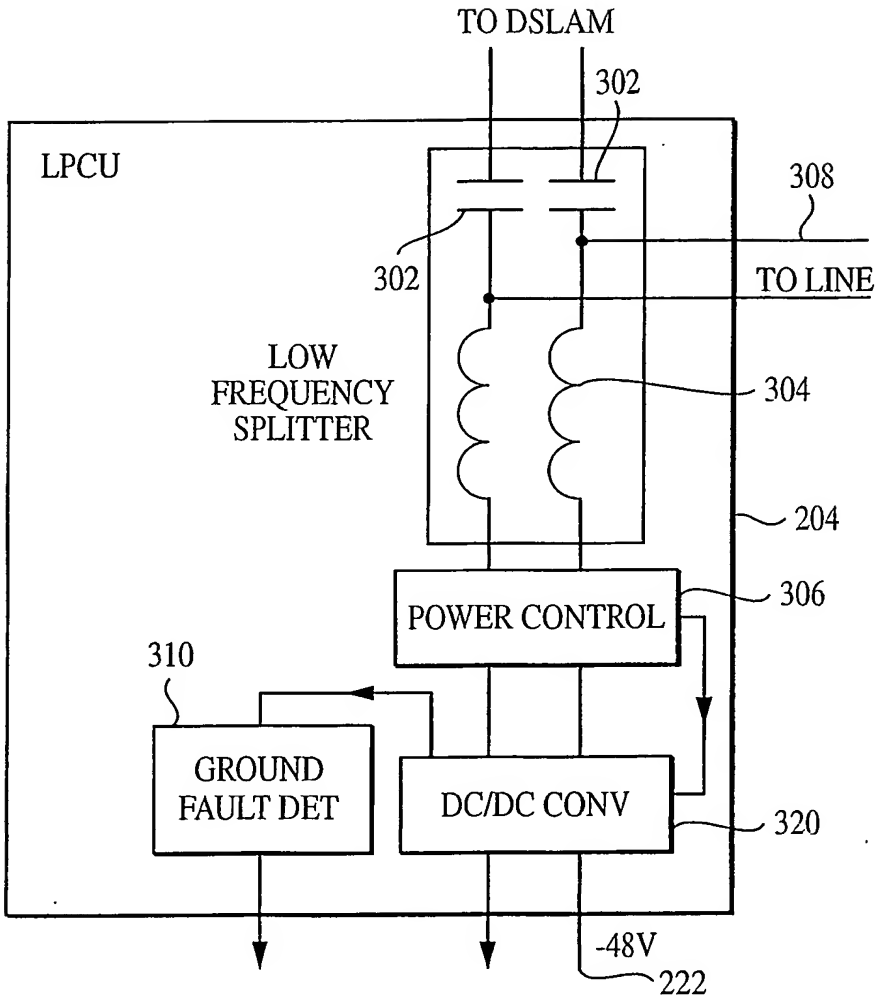
246
228
JACK
LOCKING JACK ADAPTER
PC
MONITOR
KEYBOARD
238
212
HOUSE WIRING
CENTRAL OFFICE SWITCH OR OTHER DIAL TONE SOURCE
214
220
DSLAM
202
LINE POWER CONVERTER UNIT (LPCU)
214
TELEPHONE LINE
-48V
204
OPTIONAL MID-SPAN REPEATER/ AMPLIFIER
226
WIRELESS
NOTEBOOK PC

FIG. 2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302
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308
302
TO LINE
LOW
FREQUENCY
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204
POWER CONTROL
306
310
GROUND
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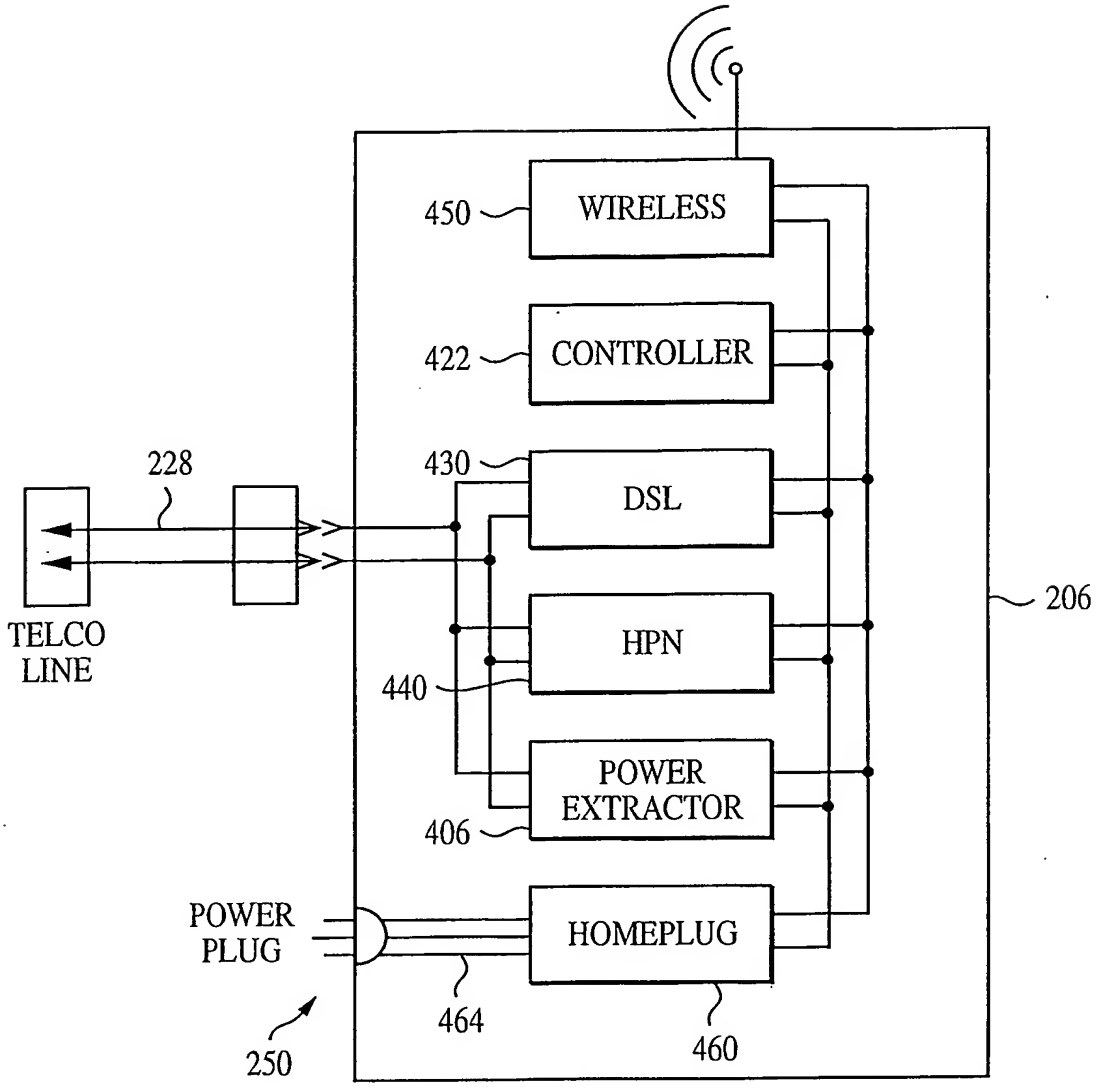
222

FIG. 3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CONTROLLER
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430
DSL
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HPN
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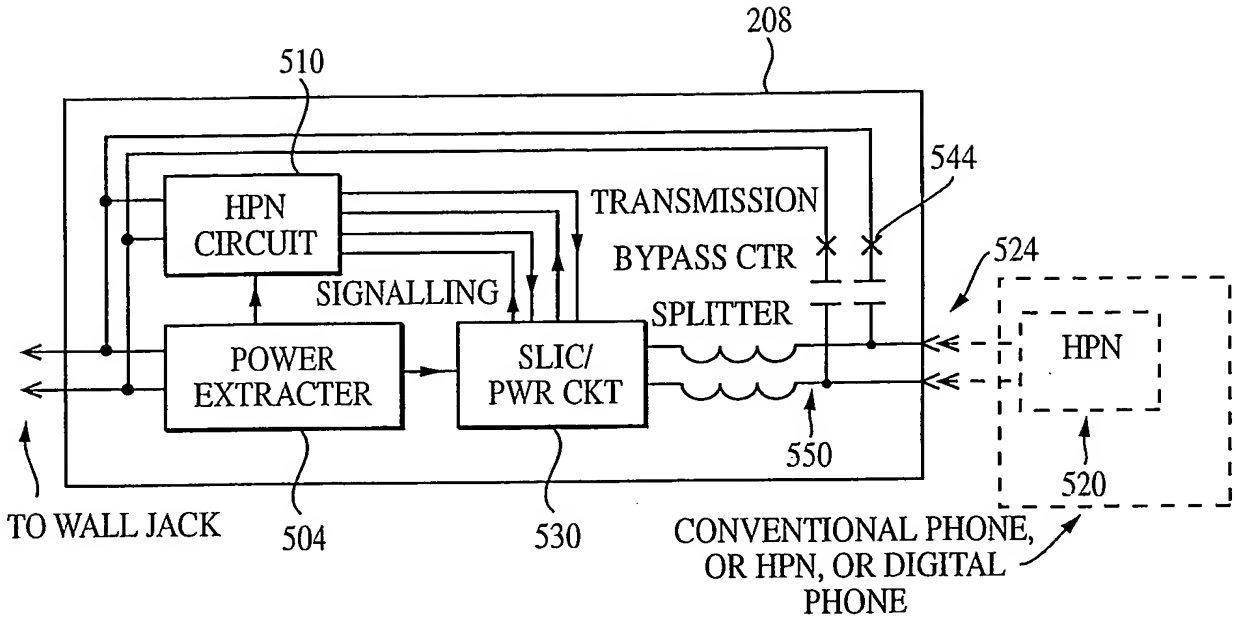
406
POWER
PLUG
HOMEPLUG
464
460
250

FIG. 4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TRANSMISSION
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HPN
POWER
EXTRACTER
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TO WALL JACK
504
530
CONVENTIONAL PHONE,
OR HPN, OR DIGITAL
PHONE

FIG. 5

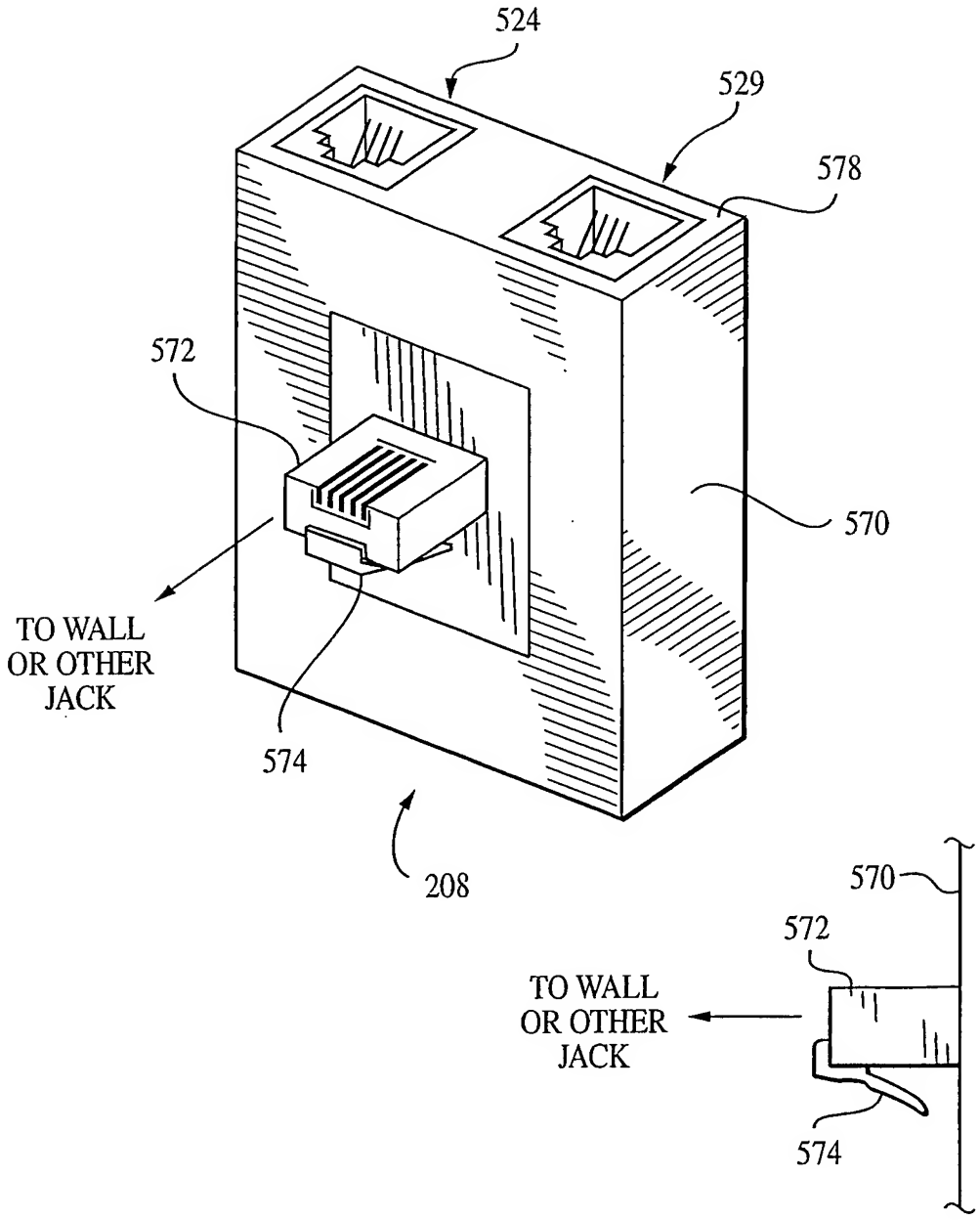
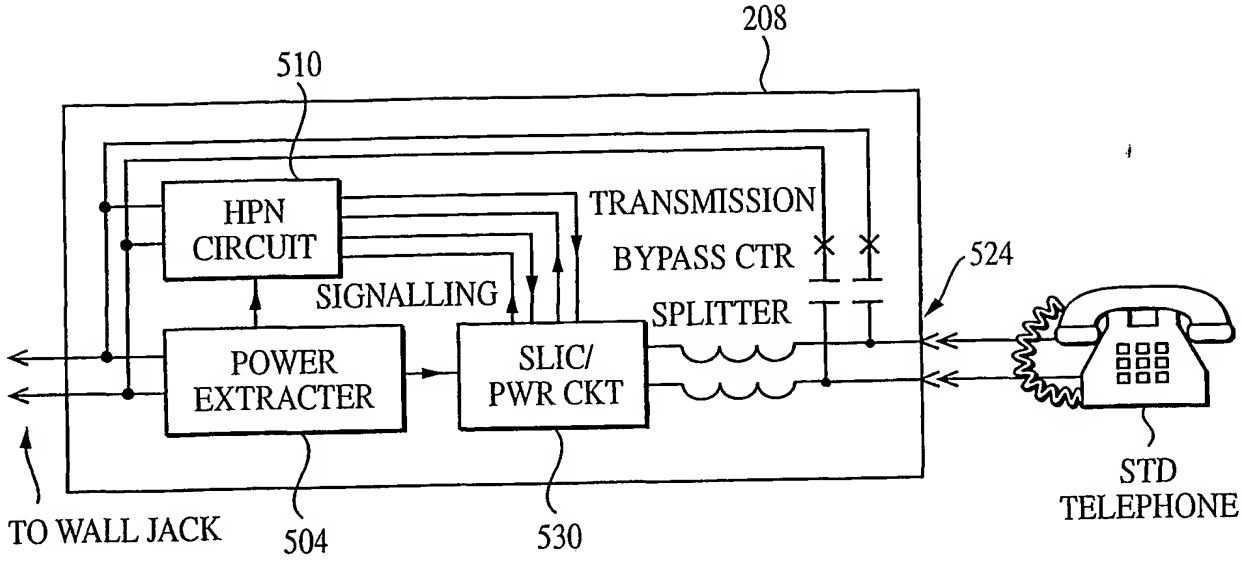

524
529
578
572
570
TO WALL
OR OTHER
JACK
574
208
570
572
TO WALL
OR OTHER
JACK
574

FIG. 5a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510
HPN CIRCUIT
TRANSMISSION
BYPASS CTR
524
SIGNALLING
SPLITTER
POWER EXTRACTER
SLIC/ PWR CKT
STD TELEPHONE
TO WALL JACK
504
530

FIG. 5b

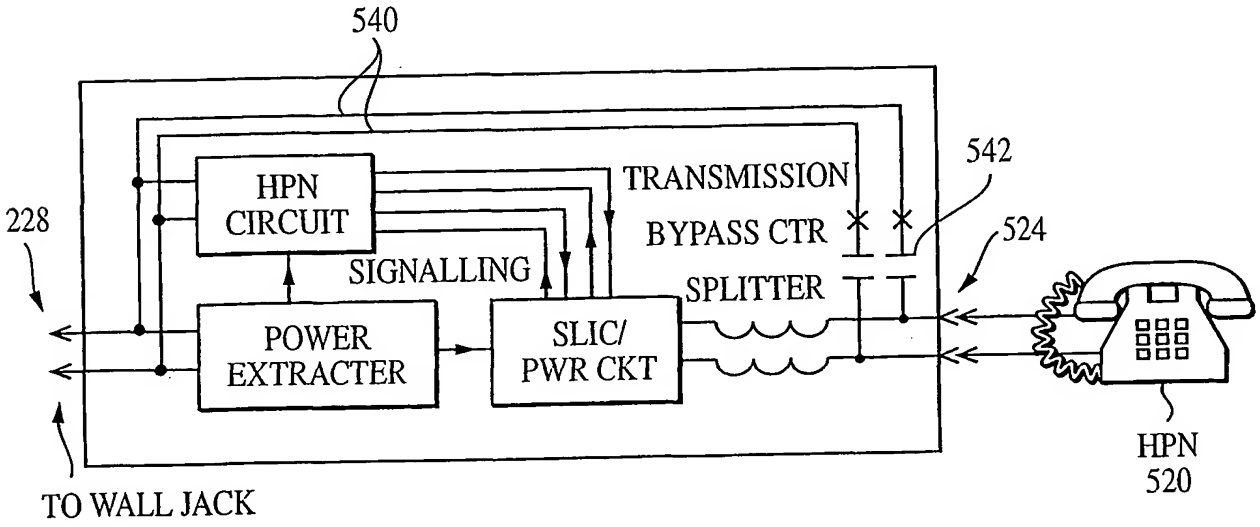
540
542
228
HPN CIRCUIT
TRANSMISSION
BYPASS CTR
524
SIGNALLING
SPLITTER
POWER EXTRACTER
SLIC/ PWR CKT
HPN 520
TO WALL JACK

FIG. 5c

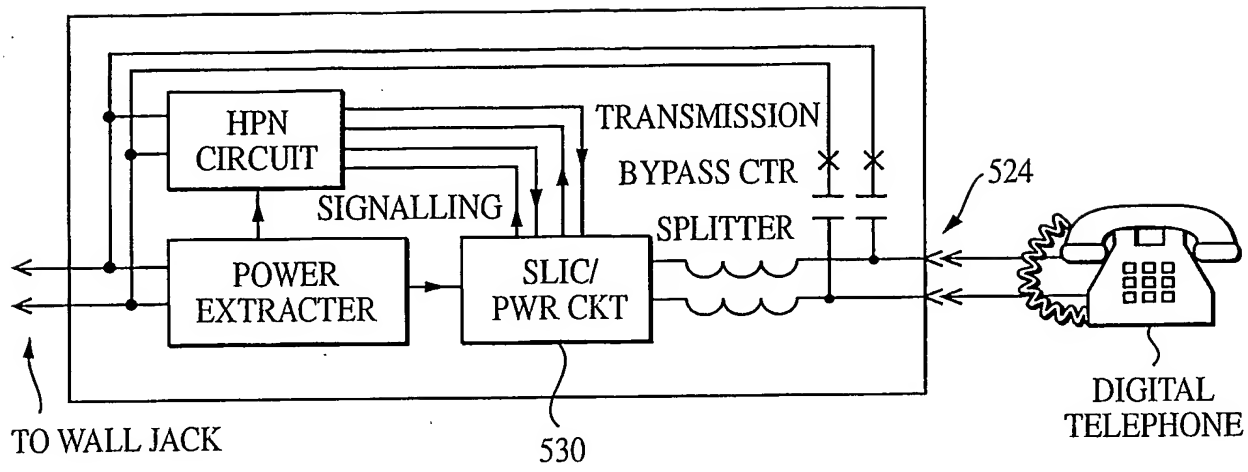
HPN
CIRCUIT
TRANSMISSION
BYPASS CTR
524
SIGNALLING
SPLITTER
POWER
EXTRACTER
SLIC/
PWR CKT
DIGITAL
TELEPHONE
TO WALL JACK
530

FIG. 5d

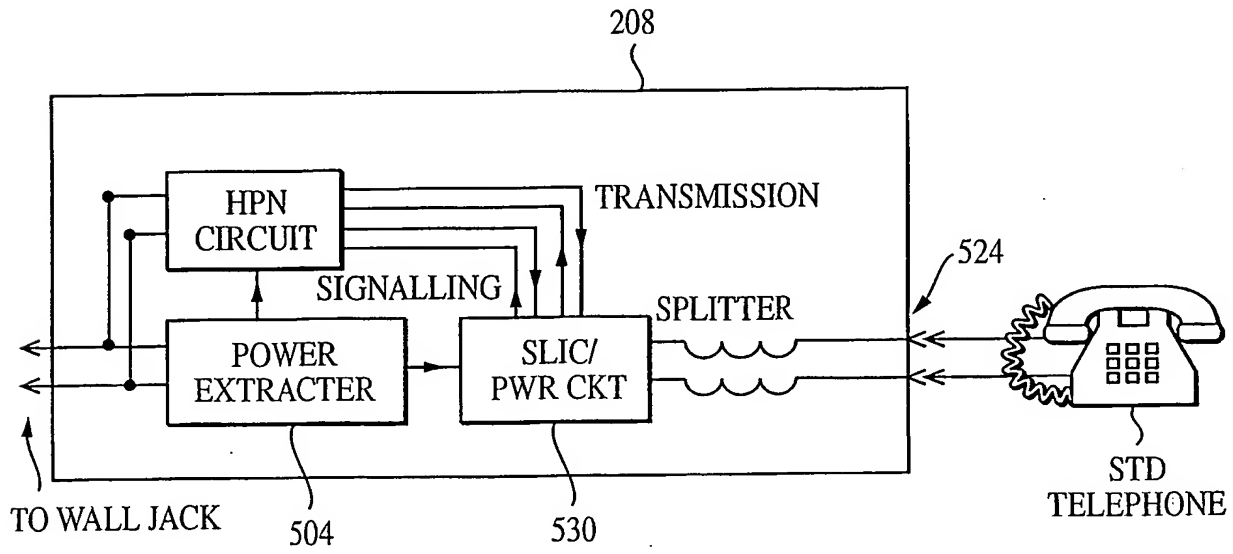
208
HPN
CIRCUIT
TRANSMISSION
524
SIGNALLING
SPLITTER
POWER
EXTRACTER
SLIC/
PWR CKT
STD
TELEPHONE
TO WALL JACK
504
530

FIG. 5e

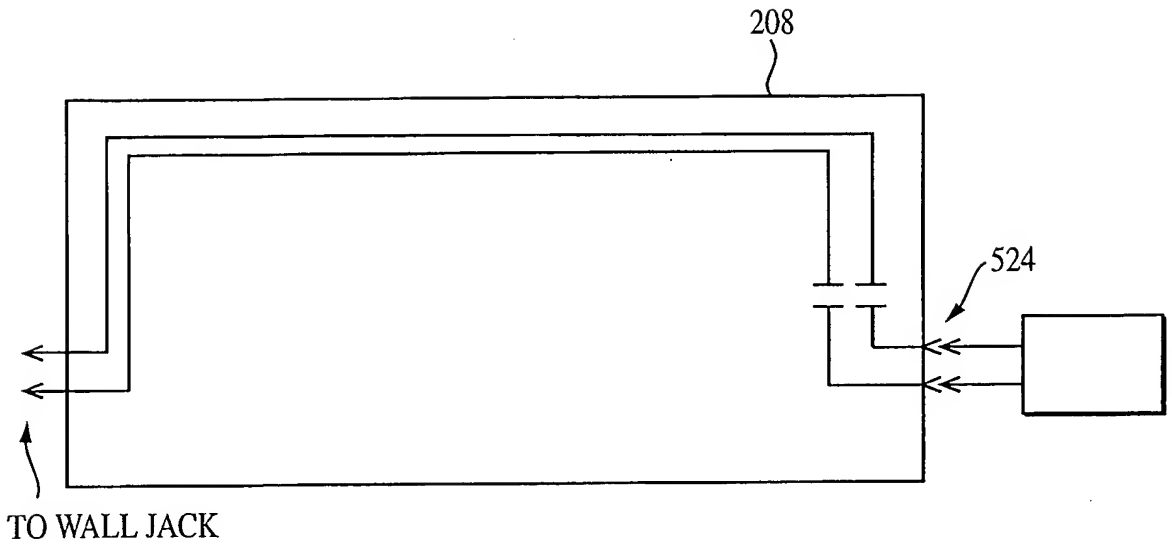
208
524
TO WALL JACK

FIG. 5f

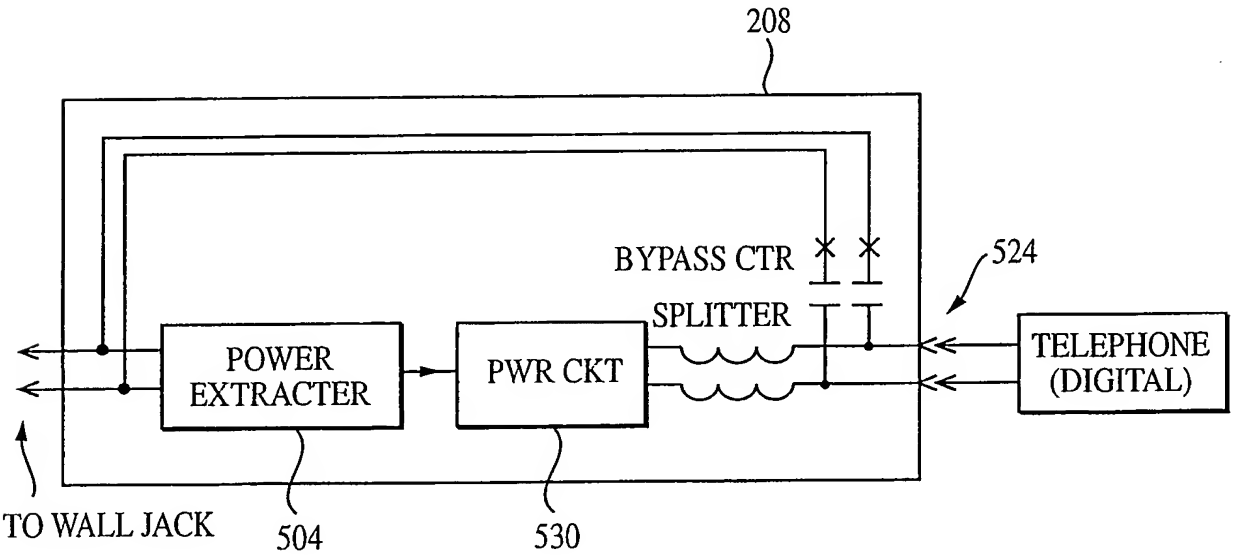
208
BYPASS CTR
524
SPLITTER
POWER EXTRACTER
PWR CKT
TELEPHONE (DIGITAL)
TO WALL JACK
504
530

FIG. 5g

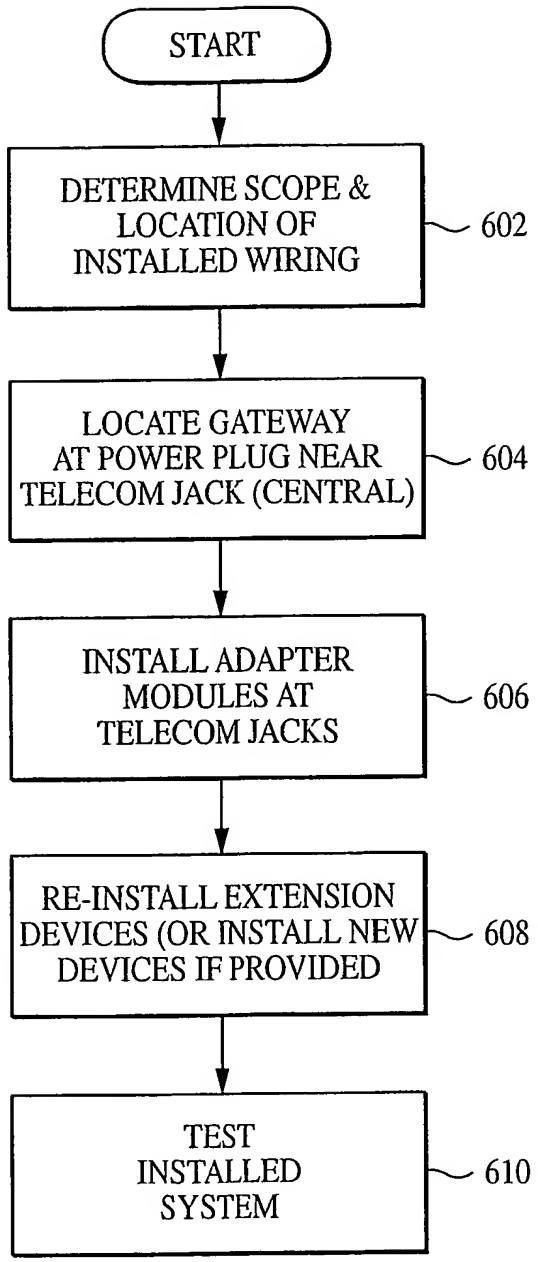
START
600
DETERMINE SCOPE & LOCATION OF INSTALLED WIRING
602
LOCATE GATEWAY AT POWER PLUG NEAR TELECOM JACK (CENTRAL)
604
INSTALL ADAPTER MODULES AT TELECOM JACKS
606
RE-INSTALL EXTENSION DEVICES (OR INSTALL NEW DEVICES IF PROVIDED
608
TEST INSTALLED SYSTEM
610

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/32290

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H04M 1/00, 9/00
US CL : 379/399.01
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 379/399.01, 93.08, 93.31; 93.36; 455/557; 375/222; 463/41; 370/401

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,504,811 A (KIKO et al) 02 April 1996 (02.04.1996), column 3, lines 15 - 46	14 ---------- 1-13, 15-20, 37-38, 41
X --- Y	US 4,578,533 A (PIERCE) 25 March 1986 (25.03.1986), column 4, lines 45-53.	25 ---------- 1-13, 15-18, 26-31, 37-38
Y, P	US 2002/0031226 A1 (SIMONSEN et al) 14 March 2002 (14.03.2002), page 2, left column, lines 28-48	4-7, 13
Y, P	US 6,441,723 B1 (MANSFIELD, Jr. et al) 27 August 2002 (27.08.2002), column 6, lines 27 - 38, column 8, lines 50 - 64.	2-3, 30
Y, P	US 6,404,393 B1 (NELSON et al) 11 June 2002 (11.06.2002), column 4, lines 9-15.	8-9
Y	US 6,298,037 B1 (SHARIFI) 02 October 2001 (02.10.2001), column 1, lines 37 - 42, column 5, lines 50 - 65.	32-36
Y	US 6,252,957 B1 (JAUREGUI et al) 26 June 2001 (26.06.2001), column 2, lines 32 - 48.	24, 26-29

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search
30 November 2002 (30.11.2002)

Date of mailing of the international search report
23 DEC 2002

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INTERNATIONAL SEARCH REPORT

PCT/US02/32290

Continuation of B. FIELDS SEARCHED Item 3:
USPAT, US-PGPUB, EPO, JPO, DERWENT, IBM_TDB, IEEE Xplore, Google, Citeseer.
search terms: modem, modulator/demodulator, power extractor, home phone network, Bluetooth, DSL.